U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Zapus hudsonius luteus*

COMMON NAME: New Mexico meadow jumping mouse

LEAD REGION: Region 2

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status
__ New candidate
_X_ Continuing candidate
___ Non-petitioned
_X_ Petitioned (October 15, 2008)

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for New Mexico meadow jumping mouse. We continue to monitor New Mexico meadow jumping mouse populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current Candidate Notice of Review (CNOR) provides information on listing actions taken during the last 12 months.

___ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined): December 2007

___ Candidate removal: Former LP: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to

conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Mammal, Family Dipodidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:
The New Mexico meadow jumping mouse (jumping mouse) is endemic to New Mexico, Arizona, and a small area of southern Colorado (Hafner et al. 1981, pp. 501-502; Jones 1999, p. 1). The jumping mouse occurred locally in Bernalillo, Otero, Rio Arriba, Sandoval, Socorro, Taos, and Valencia Counties New Mexico; Apache, Greenlee, and Yavapai Counties, Arizona; and Las Animas County and possibly La Plata and Archuleta Counties, Colorado (Jones 1999, p.1; Frey 2005a, pp.6-10; Frey 2007a, 2 pp; NMDGF 2006, pp.199-120; Underwood 2007, pp.1-4; Frey and Malaney 2009, pp. 32-33; Frey 2010, p. 1).

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: In New Mexico, the jumping mouse occurs in Colfax, Mora, Otero, Socorro, and Sandoval Counties. The species also currently occurs in Colorado in Las Animas County. In Arizona, it occurs in Apache and Greenlee Counties.

LAND OWNERSHIP:
Known occupied habitat currently totals less than 150 acres (ac) (61 hectares (ha)). Federal lands comprise approximately 105 ac (42 ha): 55 ac (22 ha) on National Forest System lands and slightly less than 50 ac (20 ha) on Bosque del Apache National Wildlife Refuge. State lands total approximately 30 ac (12 ha): 25 ac (10 ha) on New Mexico State Parks and 5 ac (2 ha) of Department of Game and Fish land. Private lands total approximately 5 ac (2 ha).

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BIOLOGICAL INFORMATION

Species Description:
The jumping mouse (*Zapus hudsonius luteus*) is grayish-brown on the back, yellowish-brown on the sides, and white underneath (Van Pelt 1993, p. 1). The species is about 7. 4 to 10 inches (in.) (187 to 255 millimeters (mm)) in total length, with elongated feet (1.2 in (30.6 mm)) and an extremely long, bicolored tail (5.1 in (130.6 mm)) (Hafner *et al.* 1981, p. 509; Van Pelt 1993, p. 1).

Taxonomy:
The currently accepted subspecies designation was developed by Hafner *et al.* (1981, pp. 501, 509). Recent microsatellite and mitochondrial DNA genetic studies confirm that the jumping mouse is a distinct subspecies from other *Zapus hudsonius* subspecies (King *et al.* 2006a, pp.12-14, 28; 2007, p.4345; Vignieri et al. 2006, p. 242).

Habitat/Life History:
The jumping mouse is a habitat specialist (Frey 2006d, p. 3; Frey and Malaney 2009, p. 36). It nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet (ft) (2,438 meters (m)) (Frey 2006d, pp. 34-45). The jumping mouse appears to only utilize two riparian community types: 1) persistent emergent herbaceous wetlands (i.e., beaked sedge and reed canarygrass alliances); and 2) scrub-shrub wetlands (riparian areas along perennial streams that are composed of willows and alders) (Frey 2005a, p. 53). It especially uses microhabitats of patches or stringers of tall dense sedges on moist soil along the edge of permanent water. Home ranges vary between 0.37 and 2.7 ac (0.15 and 1.1 ha) and may overlap (Smith 1999, p. 4).

The jumping mouse is generally nocturnal, but occasionally diurnal. It is active only during the growing season of the grasses and forbs on which it depends. During the growing season, the jumping mouse accumulates fat reserves by consuming seeds. Preparation for hibernation (weight gain, nest building) seems to be triggered by day length. The jumping mouse hibernates about 9 months out of the year, longer than most other mammals (Morrison 1990b, p. 141; VanPelt 1993, p. 1; Frey 2005a, p. 59).

The longest known lifespan of this species in the wild is 3 years, with an average lifespan less than 1 year (Smith 1999, pp. 3-4). Females breed shortly after emerging from hibernation and may give birth to 2 to 7 young after an average 19 day gestation. One litter is produced each year, usually between May and September. Young are fully developed and weaned at 4 weeks (Van Pelt 1993, p. 8). The female provides all the care for their young until they are weaned and independent. Females born in the spring are sexually reproductive at 2 months of age.

Historical Range/Distribution:
The historical distribution of the jumping mouse likely included riparian wetlands along the eastern front of the Sangre de Cristo Mountains from southern Colorado to central New Mexico. It was present throughout both the Rio Grande and Canadian River drainages in southern Colorado and New Mexico. Its historical distribution within the Pecos River Basin in New Mexico is unknown, but the species currently occurs in the Pecos River Basin, as evidenced by its presence in the Penasco River Watershed in the Sacramento Mountains (Frey 2006, p. 54; Frey and Malaney 2009, pp. 33-34). Hafner et al. (1981, pp. 501-502) reported this subspecies at 14 localities in New Mexico in the San Juan, Sangre de Cristo, Jemez, and Sacramento Mountains, and in the Rio Grande Valley between Española and Bosque del Apache National Wildlife Refuge. Hink and Ohmart (1984, p. 96) surveyed the Rio Grande from Espanola to San Acacia, New Mexico, and only found the jumping mouse present on the Pueblo of Isleta. The jumping mouse was found historically in the middle Rio Grande Valley at Bosque del Apache National Wildlife Refuge, Casa Colorado Waterfowl Area, Isleta Pueblo, and on the Ohkay

Owingeh Pueblo (formerly San Juan Pueblo) and along the Rio Chama near Espanola, New Mexico (Morrison 1988a, pp. 9 -28). Morrison (1992, pp. 308-310) subsequently verified the presence of the jumping mouse in most localities reported by Hafner *et al.* (1981, pp. 501-502), and located new populations in the Jemez Mountains (eight localities in the upper Guadalupe River drainage), the Rio Grande Valley (two new localities near Española and Isleta), the Rio Chama (one new locality), and in the Sacramento Mountains (13 localities along tributaries of the Rio Peñasco). In Arizona, the species was found in the White Mountains, southern Apache County, and in northern Greenlee County (Hafner *et al.* 1981, p. 502; VanPelt 1993, p. 8; Underwood 2007, pp. 1-4; Frey 2008, p. 2).

Current Range/Distribution:

Since the early to mid-1990s over 100 historical localities have been surveyed. Currently only 24 are extant, 11 in New Mexico (including one that is contiguous with the Colorado locality) and 13 in Arizona (Frey 2006b, p. 2; 2006d, p. 39; Frey *et al.* 2007a, p. 1; Underwood 2007, pp. 1-4; Frey 2008, p. 3; Frey 2010). The known extant locations are: two localities in the Sangre de Cristo Mountains along the border of Colorado and New Mexico; five localities in the Jemez Mountains, New Mexico; two localities in the Sacramento Mountains, one locality in the San Juan Mountains, one locality at Bosque del Apache National Wildlife Refuge, New Mexico; and 13 localities in the White Mountains, Arizona (Frey 2010). The species is no longer found along the Rio Grande at Espanola, Albuquerque, Socorro, or the Carson National Forest, New Mexico (Frey 2003, pp. 38-39, 2006c pp. 1-2; Frey *et al.* 2007a p. 1; U.S. Bureau of Reclamation (BOR) 2007, p.49; Wildearth Guardians 2008, p. 26).

The current distribution is disjunct and relictual due to habitat fragmentation (Frey 2005a, p.3; Frey 2006d, p.3; Frey and Malaney 2009, p.35). The five Jemez Mountains localities are separated from one another by an average of 4.4 miles (mi) (7.1 kilometers (km)), the two Sacramento Mountains localities are separated from one another by 20 mi (32 km), and the two Sangre de Cristo localities are separated from one another by 71 mi (114 km). The extant localities in the White Mountains of Arizona are over 200 mi (322 km) from the nearest New Mexico locality. In addition to being widely separated, these areas are quite small: half are only a few acres in size and are widely separated from other occupied localities (Frey 2005a, pp. 6 - 10; Frey 2006d, pp. 18-35). Three localities with extant populations in New Mexico contain approximately 25 ac (10 ha) of habitat in total and are much less fragmented. These three areas are managed by New Mexico State Parks, with one area being contiguous with a State wildlife area in Colorado.

The occupancy of the three unsurveyed historical localities in New Mexico is unknown at this time. One of the three historical localities in New Mexico likely still contains suitable habitat for the jumping mouse (Frey 2006c, p. 2). To our knowledge no one has visited the remaining two historical localities in New Mexico since 1987, as these areas are on Pueblo lands (Frey 2006c, p. 2). Thirteen historical locations and 17 new locations in potential habitat in Arizona were surveyed in 2008 and 2009 (Frey 2008, p. 3; 2010). The jumping mouse was documented at 13 of the 30 survey locations (seven historical and six new locations) (Frey 2008, p. 3; 2010). This represents the largest survey ever for the species in Arizona (Frey 2008, p. 2; 2010).

Population Estimates/Status:
The estimated population sizes of the jumping mouse at the extant localities was quite low (Frey 2005a, p. 64; Frey and Malaney 2009, pp. 34-35; Frey and Wright 2010, p. 12). Table 1 summarizes surveys conducted recently, which documented a substantial decline in the number of occupied localities and suitable habitat across the range of the species in New Mexico and Arizona (Frey 2005a, pp. 58-59, 2006b, pp.1-2; Underwood 2007, pp. 104; Frey 2008, p. 3; Frey 2010; Frey and Wright 2010, p. 12). Frey's jumping mouse surveys in New Mexico during a 4-year period from 2003-2006 involved 82 historically occupied sites and 10 localities that appeared to have the highest quality potentially suitable habitat. Only 36 individual jumping mice were caught during a total of 13,175 trap nights. Surveys in 2008 and 2009 at 13 historical localities in the White Mountains of Arizona found that seven still persisted (Frey 2008, p. 6; 2010). Extensive survey work was conducted in 2008 and 2009, with an additional six localities documented in Arizona (Frey 2008, pp.3, 6; 2010).

Table 1: Summary of recent survey results for New Mexico meadow jumping mouse.

Area	Number Localities Extant (No. individuals captured)	Year of Most Recent Surveys (No. localities trapped/ Trap nights)	Number Historical Localities	Notes
Sangre de Cristo Mountains (CO/NM)	2 (3)	2006 (27/ 4083)	7	1 newly discovered locality in 2006
Carson National Forest (NM)	0 (0)	2003(16/ 4564)	3	
Jemez Mountains (NM)	5 (9)	2005 (19/ 2153)	14	
Sacramento Mountains (NM)	2 (2)	2005 (18/ 2375)	15	
Bosque del Apache National Wildlife Refuge (NM)	4(14)	2009 (19/6284)	12	
White Mountains (AZ)	13 (37)	2009 (30/ 10706)	24	6 newly discovered localities in 2009
Total	24 (65)	(129/ 30165)	75	

As noted above, many of the localities where the species is known to persist are only a few acres

in size and are widely separated from other occupied localities (Frey 2005a, pp. 6-10; Frey 2006d, pp. 18-35); based on the very limited habitat at these sites we expect the populations there to be quite small. Three localities with extant populations in New Mexico contain approximately 25 ac (10 ha) of habitat each and are much less fragmented, and we expect they contain relatively larger populations than the other extant areas. These three areas are managed by New Mexico State Parks, with one area being contiguous with a State wildlife area in Colorado. The size of the other 13 localities in Arizona has not been quantified (Frey 2008, pp. 1-7; 2010).

In summary, populations of the jumping mouse are likely quite small at the majority of extant locations with only a few acres of habitat. While relatively larger areas, populations are unlikely to be substantial in the other three areas in New Mexico because they are only about 25 ac (10 ha) in size, and it is unlikely that these areas support large populations even if the home ranges overlap. Further, populations appear to be in decline. Surveys from the late 1980s and early 1990s (Morrison 1988a, pp. 9-28; 1991, p. 5; 1992, pp. 308-310) indicated a decline in the number of occupied localities, and more recent surveys (Frey 2003, p. 3; 2005, pp. 6-10; 2006d, p. 49; Frey and Malaney 2009, pp. 35-38) indicate both fewer mice and fewer occupied localities since that time. In Arizona, an additional 13 localities were documented in 2008 and 2009 (Frey 2008, pp. 2-3; 2010); however, habitat data have not yet been analyzed.

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. The jumping mouse is an obligate riparian species known only from two riparian community types: persistent emergent herbaceous vegetation (beaked sedge and reed canarygrass alliances) and scrub-shrub wetland (willow and alder alliances) (Frey 2006d, p. 53). Several risk factors related to habitat have been identified, including excessive grazing pressure from livestock, water use and management, highway reconstruction, development, recreation, and beaver (*Castor canadensis*) removal (Morrison 1990b, p. 142; Morrison 1991, pp. 16-18; Frey 2005a, pp. 58-69; Frey 2006, p. 1; 2006d, p.52; U.S. Forest Service (Forest Service) 2006, p. 79; Frey and Malaney 2009, pp. 37-38).

Livestock grazing. As noted, the jumping mouse has a short active season, hibernating about nine months each year (Morrison 1990b, p. 141; VanPelt 1993, p. 1; Frey 2005a, p. 59). It is extremely sensitive to habitat alterations because it must enter hibernation with enough fat reserves to survive the winter and to successfully breed the following spring (Morrison 1990b, p. 141). Whitaker (1972, p. 5) found that individual meadow jumping mice that enter hibernation with a low body mass do not survive. Meadow jumping mice primarily eat grass seeds (Whitaker 1972, p. 5; Morrison 1990b, p. 141). Late season livestock grazing of jumping mouse habitat, as well as other alterations of dense riparian vegetation may reduce the availability of food resources that are essential for the accumulation of fat reserves (Morrison 1987, p. 25; Morrison 1990b, p. 141; Frey 2005a, p. 59).

Impacts to jumping mouse habitat from poorly managed grazing include: trampling streambanks, burrow collapse, loss of riparian cover, soil compaction, modification of riparian plant communities, lowering water tables, and the resulting microclimatic changes from moist habitats

to mesic or xeric (Morrison 1991, pp. 16-18; Belsky *et al.* 1999, p. 37; Forest Service 2006, p. 73). Morrison (1990a, p. 1, 1990b, p. 142; 1991 pp. 16-18) concluded that excessive grazing has the greatest potential for negative impacts on the jumping mouse and riparian habitat. In 2005, Frey reported that loss of dense herbaceous vegetation and moist soil conditions along streams, resulting from excessive grazing pressure, were the primary reasons for the species' decline (Frey 2005a, pp. 58-62; Frey 2006d, p. 55). Frey stated that (2005a, p. 1; Frey 2006d, p. 55) excessive grazing is a significant threat to the species when tall, dense herbaceous vegetation is removed. In all but one case where the jumping mouse was found to be extant in 2005 and 2006, livestock were currently being excluded (Frey 2005a, pp. 58-62; Frey 2006d, pp. 49, 55; Frey and Malaney 2009, p. 37). In fact, presence of a functioning livestock exclosure was reported as the best predictor of jumping mouse occupancy (Frey 2005a, pp. 59-60). The habitat conditions at the one locality that was not fenced to exclude livestock, was similar to fenced localities because the presence of beaver naturally inhibited livestock grazing (Frey and Malaney 2009, p. 37). However, livestock have been found within five of the exclosures around extant localities (four on Forest Service and one New Mexico State Park lands) when fencing was cut or not maintained or gates were open (Frey 2006, p. 1; Forest Service2007, p. 1). This indicates that livestock grazing has the potential to threaten some of the extant localities.

In the Jemez Mountains, Morrison reported jumping mice in areas where grasses and shrubs adjacent to permanent water are dense, tall (2 to 3 ft high (0.6 to 0 .9 m)), and provide thick cover (Morrison 1985, p. 23; 1990, p. 140). In the Sacramento Mountains, Morrison (1989) reported the occurrence of cattle grazing at only 1 of 12 localities occupied by the jumping mouse. The jumping mouse apparently does not persist in areas when its habitat is subjected to heavy grazing pressure (Morrison 1985, p. 31; Frey 2005b, p. 2). In the Jemez and Sacramento mountains, Frey and Malaney (2009, p. 36) (also see, Frey 2005a, pp. 2, 41-46) found significant differences in soil moisture, vegetation density, ground cover, vertical height of vegetation, and sedge/rush cover between habitat at historic locations where the jumping mouse is currently present as compared to historic locations where it is now absent. Vertical height of vegetation where the jumping mouse was captured averaged 34.5 inches (in) (87.6 centimeters (cm)) (n=11), whereas it averaged 19.7 in (50.0 cm) (n=29) where the jumping mouse was not captured (Frey 2007, p. 1). At historic locations where the jumping mouse is extant, vertical height of vegetation averaged 32.7 in (83.0 cm) (Frey 2006d, p. 43). These data indicate that livestock grazing and trampling within jumping mouse habitat reduces the vertical height of riparian vegetation. Tall, dense herbaceous vegetation is required to maintain suitable habitat that can be occupied by the jumping mouse.

Frey (2003, pp. 10-14; 2005a, pp. 15-40; 2006d, pp. 10-33) surveyed historic jumping mouse localities on the Santa Fe, Lincoln, and Carson National Forests (New Mexico). We reviewed these data and found that current grazing guidelines on these forests have resulted in the removal of vegetation that historically provided jumping mouse habitat. Timing of livestock grazing on National Forest lands has also coincided with the active season of the jumping mouse. Current forage utilization guidelines for these forests are at conservative use levels of 30 to 40 percent (Forest Service2005, p. 4). As noted below, monitoring of current forage utilization guidelines occurs infrequently (Service 2007, p. 2). Frey (2005a, pp. 6-10) reported that the majority (23 of 31) of historically occupied localities of jumping mouse have been extirpated from U.S. Forest

Service lands in New Mexico. In addition, it appears that the Santa Fe and Lincoln National Forests have not regularly monitored forage utilization (grazing intensity) of grazing allotments within the range of the jumping mouse under current grazing guidelines (Service 2007, p.2). The Sacramento Ranger District, Lincoln National Forest, did not monitor the Agua Chiquita Allotment in 2005 or 2006, even though this was only one of two areas in the Sacramento Mountains where the jumping mouse has not been extirpated (Forest Service 2007, p. 1; Service 2007, p. 1). Similarly, we have no forage utilization monitoring from the Jemez Ranger District, Santa Fe National Forest, in areas that were historically occupied by the jumping mouse (Service 2007, p. 2). Without this monitoring information, we cannot determine whether these Forests are ensuring compliance with current forage utilization guidelines, including riparian habitat, on grazing allotments with potential jumping mouse habitat. Additionally, it is likely that current utilization guidelines, as well as the timing of grazing, would still result in the destruction, modification, or curtailment of jumping mouse habitat. Similarly, some historic localities had evidence of being fenced from livestock in the past, but the fences were left open, cut, or not maintained and fallen down (Frey 2005a, pp. 25-26, 29, 36; 2005b p.2). All of this may, in part, explain why the species has disappeared from 23 of 31 Forest Service localities that were extant in the 1980s (Frey 2005a, pp. 6-10; Table 1).

Livestock grazing is not allowed in one of the extant localities within Coyote Creek State Park in New Mexico and this has facilitated the presence of beaver, which have created a complex network of habitat that has limited human use (Frey 2006d, p. 56). In contrast, the jumping mouse has been and continues to be greatly impacted by livestock grazing on National Forest lands. The Santa Fe, Carson, and Lincoln National Forests presently are not planning any new management measures (e.g., construction of new grazing exclosures) that would preclude local extirpations or improve the current status of the jumping mouse (Service 2007, p. 2). Moreover, it appears that some of the livestock exclosures within extant localities are not regularly inspected or maintained (Frey 2005a, pp. 25-26, 29, 36; 2005b, p. 2). For example, livestock grazing has been noted in at least five of the extant localities (Frey 2006, p. 1; 2005, pp. 25-26, 29, 36; 2005b, p. 2). The majority of extant localities in New Mexico are surrounded by riparian habitat that is currently fragmented or unsuitable for the jumping mouse because of improper livestock management (Frey 2003, pp.10-14; 2005, pp.15-40; 2006d, pp. 10-33; Frey et al. 2009, p. 4). We have no information that indicates that future livestock grazing on the National Forests is likely to be reduced in the future. Therefore, we believe that future livestock grazing is likely to continue to not allow the development of tall, dense riparian vegetation in areas adjacent to the extant localities.

Fragmented riparian habitat can limit dispersal and gene flow of jumping mice (Vignieri 2005, pp.1934-1935). Additionally, the jumping mouse population sizes are probably extremely small. For example, Frey (2005 p. 64) estimated that the two localities in the Sacramento Mountains contain a total of about 200 individuals. Because the habitat between extant localities is not contiguous and the estimated population sizes are small, we expect that population expansion under current and future management is not possible or is highly unlikely. As such, survival of the jumping mouse is unlikely without additional habitat for population expansion and/or sufficient connectivity between areas to make re-occupancy possible if localized extinctions occur. We believe that the extant localities are not self-sustaining in the longterm. As a result,

we conclude that the status of the species will likely continue to decline.

Considering the magnitude and imminence of this threat to the jumping mouse and its habitat, and the vulnerability of extant localities from moderate to heavy forage utilization by livestock, we conclude that this is the most significant factor that threatens to destroy, modify, or curtail the habitat of the species.

Water Use and Management. Because the jumping mouse is dependent on moist habitat with dense herbaceous vegetation in or near riparian or wetland corridors, water diversions and associated land use changes can impact jumping mouse habitat directly, as well as alter hydrologic regimes necessary to maintain suitable habitat located downstream. It is likely that jumping mouse populations and habitat were more extensive and continuous historically along the Rio Grande Valley. However, the nature of riparian habitat throughout the Rio Grande Valley has been significantly altered since the early 1900s (Hink and Ohmart 1984, pp. 33-35; Crawford et al. 1993, pp. 32-33.). In particular, the construction of levees and other flood control measures likely has greatly reduced the amount of jumping mouse habitat over the last 100 years (e.g., see Scurlock 1998), and almost all wetlands were drained by the Middle Rio Grande Conservancy District in the 1930s (Morrison 1988a, p.38; Crawford *et al.* 1993, pp.32-33; Scurlock 1998, pp. 297, 391).

The jumping mouse has been documented along permanently flowing irrigation ditches, leading some to speculate that the species may be able to adapt and survive in these areas when they contain suitable riparian habitat (Morrison 1988a, p. 38; Morrison 1992, p. 310; Najera 1994, pp. 48-50). Still, extensive small mammal surveys have not documented the species within the majority of lands that contain riparian habitat associated with irrigation ditches between Espanola and Bosque del Apache, New Mexico (Hink and Ohmart 1984, pp.73-89; Morrison 1988a, pp. 49-51). Management activities to maintain irrigation ditches and canals (e.g., regular mowing, clearing, and burning of willow, grass, or forb riparian vegetation) impact jumping mouse habitat (Morrison 1988a, pp. 44, 51; Frey 2006d, p. 55). Some areas that may currently support potential jumping mouse habitat are destroyed or altered from these activities, whereas other areas are maintained in a currently unsuitable condition for the species. In 1984, Hink and Ohmart reported that Rio Grande Valley populations of jumping mice appeared to have been fragmented and isolated as a result of irrigation ditch and canal maintenance activities. During 71,820 trap nights, they caught only six individual jumping mice from Espanola to San Acacia, New Mexico (Hink and Ohmart 1984, pp. 23, 96), in areas that were subjected to irrigation ditch and canal maintenance activities. Najera (1994, pp. 56-57) found that jumping mouse captures decreased significantly following intensive mowing (removal of vegetation over 6 in (15 cm)) of riparian vegetation along ditches and canals. Irrigation ditch/canal maintenance is a common practice throughout the middle Rio Grande Valley, including Bosque del Apache National Wildlife Refuge (Morrison 1988b, p. 2; Najera 2004, pp. 8-9; Frey 2006a, p. 1). Currently, the irrigation canals and drains at Bosque del Apache National Wildlife Refuge are mowed only on one side with the remaining bank left as contiguous habitat for the jumping mouse, (Najera 2004, pp. 8-9; Frey 2006a, p. 1). On the refuge, the species continues to persist (Frey and Wright 2010). Still, because the number of jumping mouse has been found to significantly decrease following mowing of riparian vegetation, it is likely that mowing and other irrigation

maintenance activities on Bosque del Apache National Wildlife Refuge and other areas that could support jumping mouse habitat are impacting and will continue to destroy or modify what would otherwise be suitable habitat for the jumping mouse habitat. Further, the extensive habitat fragmentation and isolation of suitable habitat locales resulting from these actions contributes to making natural recolonization of an area unlikely in the event of local extirpation.

Jumping mouse habitat associated with springs also has been severely altered. For example, many springs in the Sacramento Mountains have been capped, diverted for agriculture, or otherwise developed (Frey 2005a, p. 63; Frey and Malaney 2009, p. 38; Frey et al. 2009, p. 4). Additionally, along the lower Rio Penasco, virtually all water is diverted for agricultural use, effectively eliminating flowing water (Frey 2005a, p. 63). In the Sangre de Cristo Mountains, nearly all valleys are under private land ownership and are irrigated through a system of diversions, channels, and drains (Frey 2006d, p .55; Frey et al. 2009, p. 4). These changes in hydrology degrade and eliminate riparian habitat, to the point that so much water is being diverted in some streams that they no longer support an herbaceous zone of riparian habitat (Frey 2006b, p. 55).

For these reasons, we find that water use and management is presently resulting in the destruction and modification of habitat and threatens to further curtail the range of the species by removing herbaceous cover and effectively eliminating, degrading, or fragmenting jumping mouse habitat. The jumping mouse is highly susceptible to localized extinction as a result of these impacts to their habitat.

Highway Reconstruction. Highway reconstruction can directly destroy or modify jumping mouse habitat (Federal Highway Administration (FHWA) 2001, p. 72; Frey 2005a, p. 63). The Federal Highway Administration has begun reconstructing New Mexico Forest Highway 12 between Fenton Lake and Señorito Pass on the Jemez and Cuba Ranger Districts of the Santa Fe National Forest. This reconstruction project involves habitat immediately adjacent to and parallel the riparian zone of four of the six remaining jumping mouse localities in the Jemez Mountains, and has the potential for indirect effects such as increased recreation, soil erosion, road maintenance (e.g., mowing or salting) and flooding that could destroy or modify jumping mouse habitat (e.g., see Frey 2006, p. 1). In addition, the project will bisect a core area of occupied jumping mouse habitat, destroying habitat suitability and fragmenting habitat, thus likely reducing the jumping mouse population in that area. Additionally, a new highway bridge will be constructed over an area where the jumping mouse was most commonly captured during surveys conducted in 2005 (Frey 2005a, p. 63). This construction will both temporarily and permanently destroy and modify the currently occupied jumping mouse habitat and potentially permanently subdivide and isolate the population (FHWA 2001, p. 72; Frey 2005a, p. 63). Furthermore, the completed highway will result in habitat alteration that has indirect effects on the jumping mouse by contributing to a risk of mortality due to vehicular strikes, as well as being more susceptible to owl predation when attempting to cross the highway.

To offset unavoidable impacts to wetland habitat from the reconstruction project, the Federal Highway Administration will attempt to create a self-maintaining wetland within potential jumping mouse habitat (Ecosystem Management Inc. 2005, pp. 1-6, 15-16; Frey 2006 p. 1; 2007,

p. 1). The U.S. Fish and Wildlife Service (Service) was involved in the concept and development of the wetland mitigation project in 2001. At that time, the project area was heavily grazed by livestock and not believed to be occupied by the jumping mouse. The project area has excluded livestock since 2005 and jumping mouse habitat is present and adjacent to one of the extant localities (Frey 2005a, pp. 24-27, 63; 2006, p. 1). Because potential jumping mouse habitat is present at the mitigation site and will be destroyed by heavy machinery and construction activities, this effort will likely result in unavoidable impacts to currently suitable, and potentially occupied, jumping mouse habitat. As a result, we find the direct impacts of the highway reconstruction project and its proposed wetland mitigation to be a threat to the species that will destroy, modify, and curtail its habitat.

Residential and Commercial Development. Morrison (1988a, p. 46) and Frey (2006d, p. 52) reported that residential and commercial development reduces, alters, fragments, and isolates habitat to the point where the jumping mouse can no longer persist in some areas. With agricultural and residential development, many wet meadows along the Rio Grande Valley have disappeared (Morrison 1988a, p. 38). At historic localities, jumping mouse habitat is no longer intact, and fragmentation has isolated the localities and likely rendered them unsuitable (Frey 2005a, p.52). Morrison (1988, p. 46) reported that commercial development filled marshes and riparian areas adjacent to the Rio Grande in Espanola, leaving little to no jumping mouse habitat. Development is considered to likely have extirpated populations of the jumping mouse in Albuquerque, Espanola, and Taos, New Mexico (e.g., see Morrison 1988a, p. 46; Frey 2006c, pp. 1-2; 2006d, p. 52; BOR 2007, p. 49). Frey (2005, p. 63) indicated that a historic locality in the Sacramento Mountains was also eliminated due to development.

Residential and commercial development fragments riparian habitat, which can limit dispersal and gene flow of jumping mice (e.g., see Vignieri 2005, pp. 1934-1935). Development also has the potential to degrade or eliminate suitable habitat. Areas of private land contain jumping mouse habitat; however, it is unknown whether the species is present (Frey 2005a, p. 59; 2006d, pp. 22, 27, 29). Still, the continuing development of private land within jumping mouse habitat is foreseeable (e.g., the Taos Valley). Therefore, residential and commercial development has the potential to further curtail the range of the species by removing dense herbaceous riparian vegetation that would result in the destruction and modification of jumping mouse habitat.

Coalbed Methane Development. A Texas oil and gas company recently purchased mineral rights to drill for coalbed methane within the Lake Dorothey State Wildlife Area in Colorado (Wong 2007, p. 1). This potential oil and gas development area encompasses one of the extant localities contiguous with locality of Sugarite Canyon State Park in New Mexico. Lake Dorothey State Wildlife Area in Colorado and Sugarite Canyon State Park in New Mexico are one locality. The oil and gas company plans to drill five exploratory wells on the western edge of the Lake Dorothey State Wildlife Area (Wong 2007, p. 1). The only access to Lake Dorothey is from the south through Sugarite Canyon State Park. Coalbed methane development and related infrastructure have the potential to cause indirect impacts to Segerstrom Creek, the occupied jumping mouse locality. The drilling proposal was recently withdrawn due to a lawsuit by the City of Raton, New Mexico to protect their water supply (Wildearth Guardians 2008, p. 58). However, we will continue to explore this potential threat with the Colorado Division of

Wildlife, New Mexico State Parks, and New Mexico Department of Game and Fish.

Recreation. The development of streamside trails and large bare compacted areas used for camping has been and continues to be reported throughout historic jumping mouse habitat in areas of the Jemez Mountains (Frey 2005a, pp. 27-28). Erect riparian vegetation is readily damaged by trampling. Streamside areas, which may also be suitable habitat or support the jumping mouse, are favored locations for many campers (Frey 2005a, pp. 27-28). Frey (2005, p. 63) observed a variety of these impacts (e.g., barren ground, trampled plants, multiple trails, and vehicle tracking from all-terrain vehicles and motorcycles) in areas that were historically occupied by the jumping mouse. The demand for developed and dispersed camping and recreation, which is generally greatest from May through September (the same activity period for the jumping mouse), often exceeds capacity of the Jemez and Sacramento National Forests. Four of the extant localities are currently located within campgrounds, while two extant localities are immediately adjacent to areas heavily used by dispersed camping. These six extant localities are surrounded by riparian habitat that is currently fragmented or unsuitable for the jumping mouse due, in part, to recreational impacts. Recreational use in these areas will likely continue to remove tall, dense riparian vegetation from areas adjacent to the extant localities. These impacts likely are reducing the quality or quantity of suitable habitat in and around developed campgrounds or undeveloped campsites known to support the jumping mouse.

One jumping mouse population in the Sangre de Cristo Mountains is located within a heavily-used State Park. Similarly, Frey (2005, p. 24) reported that jumping mice were found within a small wet meadow that was adjacent to a campground in the Jemez Mountains, but because of saturated soils and marshy conditions, had limited human use. From these observations, it appears that the species is able to persist in circumstances when microhabitat conditions create dense riparian vegetation or saturated soils that are difficult for humans to traverse. In conclusion, we believe that impacts to the jumping mouse from these recreational uses will continue to destroy or modify jumping mouse habitat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
We have no information indicating that the New Mexico jumping mouse is being used for commercial, recreational, scientific, or educational purposes. Therefore, this factor is not a basis for concluding that a proposal to list the subspecies is appropriate.

C. Disease or predation.
We have no information that indicates disease poses a substantial risk to the jumping mouse. As described above, highway reconstruction of New Mexico Forest Highway 12 between Fenton Lake and Señorito Pass on the Jemez and Cuba Ranger Districts of the Santa Fe National Forest involves habitat of four of the six remaining jumping mouse localities in the Jemez Mountains. Although the reconstruction is likely to make jumping mice more susceptible to owl predation when mice attempt to cross the highway in that area, we do not have sufficient information to determine if the increased risk is substantial or if it likely would result in extirpation of one or more of the four populations, either due solely to predation or the effects of predation in combination with other risk factors in those areas. We have no information regarding predation risk elsewhere in the range of the species. Predation is a naturally occurring event in the life

history of the jumping mouse and presumably is not a significant risk factor for relatively large populations. It might be a factor in very small populations. Overall, we have insufficient information to conclude that either disease or predation are a basis for determining that a proposal to list the jumping mouse is appropriate.

D. The inadequacy of existing regulatory mechanisms.
One primary cause of decline of the jumping mouse is the loss, degradation, and fragmentation of habitat. As described below, Federal and State laws have been insufficient to prevent past and ongoing losses of the habitat of the jumping mouse, and are unlikely to prevent further declines of the species.

In 2006, the New Mexico Department of Game and Fish (NMDGF) reclassified the jumping mouse from threatened to endangered, after they determined that the most immediate threat to the species was from the very substantial reduction in vegetation along streams in many areas of historic occurrence due to drought and excessive grazing (NMDGF 2006, p. 120). This designation provides the protection of the New Mexico Wildlife Conservation Act, which prohibits direct take of the species except under issuance of a scientific collecting permit. However, this only conveys protection from collection or intentional harm; no New Mexico State statutes address habitat protection, indirect effects, or other threats to the species identified by the State as endangered. Because most of the risks to the jumping mouse are from effects to habitat, protecting individuals from direct take will not ensure long-term protection of the subspecies.

NMDGF has the authority to consider and recommend actions to mitigate potential adverse effects to the jumping mouse during its review of development proposals. As noted, NMDGF's primary regulatory venue is under the New Mexico Wildlife Conservation Act. There are no statutory requirements under NMDGF's jurisdiction that serve as an effective regulatory mechanism for reducing or eliminating the threats (see Factor A above) that may adversely affect the jumping mouse and its habitat. Although the New Mexico State statutes require the NMDGF to develop a recovery plan that will restore and maintain habitat for the species, the species does not have a finalized recovery plan, conservation plan, or conservation agreement (NMDGF 2006 p. 430). The NMDGF began developing a recovery plan for the species, but stopped the process because of a lawsuit. It is unknown whether the recovery plan will be completed in the near future. As such, existing New Mexico State regulatory mechanisms are currently inadequate to protect the jumping mouse.

The NMDGF has adopted a wetland protection policy whereby they do not endorse any project that would result in a net decrease in either wetland acreage or wetland habitat values. This policy affords limited protection to the jumping mouse habitat because it is advisory only; destruction or alteration of wetlands is not regulated by State law.

The Arizona Game and Fish Department (AGFD) has included the jumping mouse in Wildlife of Special Concern in Arizona (WSCA) (AGFD 2005, p. 3). The March 16, 1996, version of WSCA list identifies wildlife in Arizona that are regarded from a state perspective as extinct, extirpated, endangered, or threatened (AGFD 1996). The jumping mouse is listed as a threatened species on the WSCA (AGFD 1996, p. 25). The WSCA list is used by AGFD

cooperators and outside contractors for projects developed and reviewed under environmental compliance with the National Environmental Policy Act (NEPA), the Act, and other Federal laws. However, this designation provides no regulatory protection for the jumping mouse in Arizona.

The State of Arizona Executive Order Number 89–16 (Streams and Riparian Resources), signed on June 10, 1989, directs State agencies to evaluate their actions and implement changes, as appropriate, to allow for restoration of riparian resources. We do not have information regarding the implementation or effectiveness of this Executive Order or any examples indicating it has reduced adverse effects of some State of Arizona actions on the habitat of the jumping mouse, and we note that historically occupied jumping mouse localities have continued to experience population extirpation. The Executive Order applies only to the actions of State agencies and thus is limited in terms of the areas and actions covered.

The Colorado Division of Wildlife's (CDOW) Comprehensive Wildlife Conservation Strategy lists the jumping mouse as a Species of greatest conservation need, Tier 1 (CDOW 2006, p. 40). The jumping mouse is considered threatened under the nongame provisions of the CDOW, and can only be taken legally by permitted personnel for educational, scientific, or rehabilitation purposes. This designation provides no regulatory protection for the habitat of the jumping mouse in Colorado.

Under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*) and the National Forest Management Act of 1976 (16 U.S.C. 1600 *et seq.*), the Forest Service is directed to prepare programmatic-level management plans to guide long-term resource management decisions. In addition, Forest Service planning regulations in place at the time Forest plans were written, for the areas including jumping mouse habitat, included direction to manage habitat to maintain viable populations of existing native and desired nonnative vertebrate species in planning areas (these regulations were at 36 CFR 219.19). These regulations resulted in the preparation of a variety of land management plans by the Forest Service that address management and resource protection of areas that support, or in the past supported, populations of the jumping mouse. The species was historically known from the Carson, Santa Fe, and Lincoln National Forest, New Mexico, and the Apache-Sitgreaves National Forest, Arizona (Hafner *et al.* 1981, p.501-502; Morrison 1990b, p. 137, 1992, p. 309; Frey 2005a, pp. 3-21; 2006, pp. 51-56). The jumping mouse has been on the Regional Forester's Sensitive Species List since 1990 (Forest Service 1999). However, based on the information available to us, the Forest Service has not minimized or avoided potentially adverse impacts of livestock grazing to the jumping mouse (see discussion under Factor A, above). Until the Forest Service revises their Forest Plans, they are required to maintain or enhance the viability of species on this list by considering species in their project biological evaluations.

The Regional Forester's Sensitive Species List policy is applied to projects implemented under the 1982 National Forest Management Act Planning Rule. As noted, the jumping mouse is designated a sensitive species, where the Forests are operating under the forest plan for the 1982 Rule. On April 21, 2008, a new Forest Service planning rule (73 FR 21468) was finalized. However, on June 30, 2009, the United States District Court for the Northern District of

California issued a decision in *Citizens for Better Forestry* v. *United States Department of Agriculture*, No. C 08-1927 CW (N.D. Cal. June 30, 2009). The court enjoined the Forest Service from implementing and using the 2008 planning rule and remanded the matter to them for further proceedings. The Government has not yet determined whether to appeal the District Court's June 30, 2009, decision to the Ninth Circuit Court of Appeals. Nevertheless, on July 15, 2009, the Forest Service issued legal guidance that the planning rule from November 9, 2000 (65 FR 67514) is now in effect (Forest Service 2009). The intent of the Regional Forester's sensitive species designation under the operative Forest Service planning rule is to provide a proactive approach to conserving species to prevent a trend toward listing under the Act, and to ensure the continued existence of viable, well-distributed populations. In practice, the Forest Service has taken no actions to conserve and avoid impacts to the jumping mouse and its habitat. For this reason, it is doubtful that this planning rule will be adequate to protect the jumping mouse.

In 2004, the Santa Fe National Forest amended their Forest Plan and dropped a standard and guideline that required a joint review with NMDGF of the jumping mouse's status and management needs (Forest Service 2004, p. 11), and replaced it with a requirement to coordinate with State and Federal Agencies to identify potential adverse effects and remedies (Forest Service 2004, p. 19). The Forest Service indicated that this amendment would result in the same amount or more protection for the jumping mouse. Even with this amendment and knowledge of the jumping mouse's recent documented decline from National Forest lands, the Forest Service has not responded to or changed management of grazing allotments where small localized jumping mouse populations are at high risk of extirpation (Service 2006, p. 3; Frey 2005b; USFS 2007, pp. 1-6), which appears to be inconsistent with direction in Forest Service Manual 2672.4 to avoid or mitigate negative impacts to sensitive species. In 2008 and 2009, extensive surveys were conducted on the Apache-Sitgreaves National Forest for the jumping mouse on their lands (Frey 2008, pp. 2-3; 2010). The jumping mouse was found to persist at 13 of 30 sites surveyed. Nevertheless, the jumping mouse likely faces impacts on the Apache-Sitgreaves similar to those identified on the Santa Fe, Lincoln, and Carson National Forests under the jurisdiction of the Forest Service (e.g., see entire reports by Frey 2005a, 2005b, 2006d). None of the Forests within the range of the jumping mouse currently have management plans that address the species, nor have they developed population viability objectives or habitat management guidelines to address the needs of the jumping mouse or help ensure its viability on National Forest System lands.

The Lacey Act, as amended (16 U.S.C. 3371 *et seq.*) prohibits the import, export, sale, receipt, acquisition, purchase, and engagement in interstate or foreign commerce of any species taken, possessed, or sold in violation of any law, treaty, or regulation of the United States, any Tribal law, or any law or regulation of any State. Since the jumping mouse is not presently the subject of commercial utilization (see discussion of Factor B, above), the Lacey Act does not provide protection that is related to factors impacting the subspecies.

Based on this review, we conclude that existing State and Federal regulations are inadequate.

E. Other natural or manmade factors affecting its continued existence.

Global climate change and Drought. The global average temperature has risen by approximately 1 degree F (0.6 degrees C) during the 20th Century (Intergovernmental Panel on Climate Change

(IPCC) 2001, p. 5). There is an international scientific consensus that most of the warming observed has been caused by human activities (IPCC 2001, pp. 4-6), and that it is very likely due to manmade emissions of carbon dioxide and other greenhouse gases (IPCC 2001, pp. 4-6; 2007, p. 3). Warming temperatures have been documented in recent decades in the southwestern United States. In Arizona, mean annual temperature has increased by 1 degree F (0.6 degree C) per decade beginning in 1970 and 0.6 degree F (0.3 degree C) per decade in New Mexico (Lenart 2005, pp. 3-4). Higher temperatures, compounded with drought, lead to higher evaporation rates which may reduce the amount of runoff, groundwater recharge, and consequently spring discharge (Stewart et al. 2004, pp. 223-224). Increasing temperatures are likely to amplify the stress-inducing effects of drought on species and ecosystems, while further increasing the threat of long-term aridity (e.g., see Cook *et al.* 2004, pp. 1015-1018). Jumping mouse habitat will be negatively affected by climate changes occurring now and into the future as the warming trend is expected to continue.

The southwestern United States may be entering a period of prolonged drought (McCabe *et al.* 2004, pp. 4137-4140). Drought has a major influence on the status and distribution of the jumping mouse (Frey 2005a, p. 62; Frey and Malaney 2009, p. 37). Vignieri (2005, p. 1934-1935) found that dispersal and gene flow in riparian-associated jumping mice were largely determined by habitat connectivity. During periods of drought, jumping mouse habitat can shrink. In fact, Frey (2005, p. 62) observed a pattern of extirpation of jumping mouse populations in small isolated patches of suitable habitat in the Sacramento Mountains. It is probable that this pattern was related to little or no dispersal of jumping mice from lack of connectivity between patches of habitat. When suitable riparian habitat between extant localities is not contiguous or becomes fragmented from drought and population sizes are small, we believe that population expansion from isolated localities is not possible or highly unlikely. Similarly, we believe that the extant localities are not self-sustaining in the long-term. We agree with Frey (2005, p. 62; 2006a, p. 55; 2006b, p. 2), that, the combined effects of few exclosures and moderate to heavy livestock forage utilization in almost all riparian areas, and drought currently threaten the jumping mouse.

Floods. Livestock grazing in riparian areas of the western U.S. has had a significant impact on channel morphology and water tables (Belsky *et al.* 1999, p. 8). When upland and riparian vegetation is removed by livestock and as hillsides and streambanks are compacted by their hooves, less rainwater enters the soil and more flows overland into streams, creating larger peak flows (Belsky *et al.* 1999, p. 8). Moderate and high rainfall events within sites that are grazed by livestock are more likely to result in high energy and erosive floods, which deepen and reshape stream channels (USDI 1994, pp. 4-26). Frey (2005, p. 29-30, p. 34, p. 36; 2006d p. 29, p. 33) observed abundant livestock within historical jumping mouse localities with little water in the stream, the streambed incised, and banks supporting little to no riparian vegetation. These areas were currently unsuitable for the jumping mouse. From these data, it appears that livestock grazing in at least some historical localities has had an impact on channel morphology, resulting in high energy erosive floods.

Livestock utilization of riparian habitat in the western United States. makes these areas susceptible to soil loss and downcutting of perennial and intermittent streams from cloudbursts

(Leopold 1921, pp. 267-273; Rich 1911, pp. 237-245; Belsky 1999, p. 8). Downcutting of perennial streams results in a lower water table, transforming moist or mesic habitats into xeric habitats. For example, riparian plants and their associated wildlife species are often replaced by upland species such as sagebrush (*Artemesia* spp.) and juniper (*Juniperus* spp.), which can tolerate these drier soils (Belsky et al. 1999, p. 8). Highly productive soils and a water table near the surface appear important for supporting the plant communities that can armor banks against snowmelt and rainstorm events and provide habitat for the jumping mouse. Additionally, with less water entering upslope and riparian soils, less water is available to provide late-season flows. Consequently, the high intensity floods of the spring and early summer are often followed by low and no flow in late summer and fall (Belsky *et al.* 1999, p. 8). We believe these processes identified above from areas of the western United States likely hold true for some of the extant jumping mouse localities.

Scouring floods that remove riparian vegetation have been reported within areas occupied by the jumping mouse (Frey 2006, p. 1). Alternatively, jumping mice appear to move to higher ground when flooding inundates an area, but return after the waters recede (Najera 1994, p. 58; Morrison 1987, pp. 29-30) if the habitat remains.

The limited geographic range of the jumping mouse increases the threat of extinction for this species given the expected continuing loss and degradation of suitable habitat and increased risks of extinction from random or manmade events. Small populations are subject to extirpation from random variations in such factors as the demographics of age structure or sex ratio, and from disease and other natural events (Wilcox and Murphy 1985, pp. 879-887). The dynamic nature of riparian habitat and the probable small size of the populations that inhabit them suggest that many of these localities are not likely to persist for long periods. Because jumping mouse localities are disjunct and isolated from each other, and potential habitat areas are isolated and separated by large areas of unsuitable habitat, the species is particularly vulnerable to localized extinction if its habitat is degraded or destroyed. Additionally, populations are likely very limited in size. As a result, one random natural event in the riparian habitat where the jumping mouse is found could result in the loss of one of the extant localities.

This species occurs in an arid region plagued by drought, but also moderate and high rainfall events, leading to scouring floods within jumping mouse habitat. Therefore, we believe that drought and flooding are a present threat that could affect the continued existence of the species.

Beaver removal. Trapping nearly eliminated beaver from New Mexico. Frey (2006d, p. 56) found that the reduction in distribution and abundance of beaver in New Mexico has likely impacted the jumping mouse. Huey (1956, p. 1) reported that beaver were nearly extinct in New Mexico by the 1890s. Beaver were stocked throughout New Mexico by the NMDGF in the 1940s and 1950s (Findley *et al.* 1975, p. 188). Beavers are listed in NMDGF's Comprehensive Wildlife Conservation Strategy for New Mexico (2006, p. 222) as a Species of Greatest Conservation Need population because of their role in improving riparian habitats. Nevertheless, beaver continue to be removed at some historic jumping mouse localities, which may degrade jumping mouse habitat. The jumping mouse is often associated with beaver activity because they often create diverse wetland communities (Frey 2006d, p. 52; Frey and Malaney 2009, p.

37). Within areas occupied by beaver, human and livestock use is likely limited due to the difficulty in traversing these areas. Frey (2006d, p. 24) found human use virtually non-existent within beaver complexes, due to saturated soils and dense vegetation. Because beaver continue to be trapped and removed from historic jumping mouse localities, we believe this may threaten the species now and in the future.

Small, isolated populations. As described above, the known extant localities are fragmented and isolated. The potential for recolonization of historical localities or interchange between most of the extant sites is unlikely due to the distances between small patches of suitable habitat. Even if the three historical jumping mouse localities in New Mexico, whose status is currently unknown, are still extant, jumping mouse localities would continue to be isolated from one another. Fragmented riparian habitat can limit dispersal and gene flow of jumping mice (Vignieri 2005, pp. 1934-1935). Additionally, the jumping mouse population sizes are probably extremely small. For example, Frey (2005 p. 64) estimated that the two localities in the Sacramento Mountains contain a total of about 200 individuals. Because the habitat between extant localities is not contiguous and the estimated population sizes are small, we expect that population expansion under current and future management is not possible or is highly unlikely. As noted above, small populations are at high risk of extirpation from random or manmade events. Consequently, we believe that the extant localities are not self-sustaining in the long-term. As a result, we conclude that the status of the species will likely continue to decline.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: There are currently no conservation measures that are being implemented for the protection of the jumping mouse. However, historical livestock exclosures are present around extant localities on Forest Service lands. Although the exclosures were not erected to protect the jumping mouse, they provide a conservation benefit to the species by limiting, but not completely excluding all grazing. At times, fencing has not been maintained or gates have been left open. The Bureau of Reclamation and Service funded a study investigating whether management actions affect the jumping mouse on Bosque del Apache National Wildlife Refuge. This Master's project began in January 2009 and will continue for 2.5 years. This study found that the jumping mouse is still extant on Bosque del Apache National Wildlife Refuge , albeit abundance is significantly lower than the previous studies in the 1990s (Frey and Wright 2010, p. 12). Still, we hope to apply the knowledge gained from this study to other jumping mouse localities. Moreover, during 2009, surveys documented an additional 6 new localities in Arizona (Frey 2010). The jumping mouse is also a candidate spotlight species for the Service in New Mexico. As such, we have developed a list of major conservation actions in order to improve the status of the species by decreasing the magnitude and immenence of threats (Service 2009, 3 pp.). To date, none of these major conservation actions has been completed.

SUMMARY OF THREATS: The threats that have been identified are excessive grazing pressure, water use and management, highway reconstruction, development, recreation, and beaver removal (Morrison 1990b, p. 142; 1991, pp. 16-18; Frey 2005a, pp. 58-69; 2006, p. 1; 2006d, p. 52; Forest Service 2006, p. 79; Frey and Malaney 2009, pp. 37-38). Livestock grazing and trampling within jumping mouse habitat, reduces the density and vertical height of riparian vegetation, which is required to maintain jumping mouse localities. Considering the magnitude

and imminence of this threat to the jumping mouse and its habitat, and the vulnerability of extant localities from moderate to heavy forage utilization by livestock, we conclude that this is the most significant factor that presently threatens to destroy, modify, or curtail the of habitat of the species. We also find that water use and management is presently resulting in the destruction and modification of habitat and has the potential to further curtail the range of the species by removing herbaceous cover and effectively eliminating, degrading, or fragmenting jumping mouse habitat. A highway reconstruction project and associated wetland mitigation also threatens four of the six remaining jumping mouse localities in the Jemez Mountains. Additionally, residential and commercial development fragments riparian habitat, which can limit dispersal and gene flow of jumping mice. Recreational use in and around developed campgrounds or undeveloped campsites known to support the jumping mouse will continue to destroy or modify jumping mouse habitat. Existing regulatory mechanisms (Factor D) have not been adequate to prevent the continuing decline of jumping mice. Finally, climate change, drought, flooding, and beaver removal are a present threat that could affect the continued existence of the species.

The documented decline in occupied localities, in conjunction with the small numbers of individuals captured, are linked to widespread habitat alteration (Frey 2005a, pp. 58-62; Frey 2006d, p. 55; Frey and Malaney 2009, pp. 35-38). Moreover, the highly fragmented nature of its distribution is also a major contributor to the vulnerability of this species and increases the likelihood of very small, isolated populations being extirpated. Even if suitable habitat exists (or is restored) in some locations, the likelihood of recolonization from other populations is extremely limited (Morrison 1991, pp. 17-23).

One of the 24 localities has no apparent ongoing threats. This locality is located within New Mexico State Park lands (Coyote Creek State Park, near Mora, New Mexico). This locality was only discovered in 2006. There is one other locality that has no apparent ongoing threats, but we recently found that coalbed methane exploratory wells and possible production field are proposed adjacent to the area. Still, we have no further information to evaluate the likelihood that this proposal would result in the destruction and modification of jumping mouse habitat. Nevertheless, these two jumping mouse localities are disjunct and isolated from each other, and from the other extant localities. As noted above, the species is particularly vulnerable to localized extinction if its habitat is degraded or destroyed. Although we have no quantitative estimate of population size or information on the stability of any locality, it is likely the other localities have small populations because the areas all are very limited in size. One random natural event in the riparian habitat where the jumping mouse is found could result in the loss of any of the localities. For these reasons, the Service finds that this species is warranted for listing throughout its range. We therefore find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES: Riparian exclosures, more restrictive forage utilization guidelines, monitoring and compliance with forage utilization guidelines, and habitat restoration projects will be necessary before significant risk reduction for the jumping mouse is achieved.

It is likely that this impact will not be reduced without the exclusion of grazing in some areas. Additionally, active management of livestock between excluded areas will likely be necessary to facilitate dispersal between occupied habitats or recolonization of new areas.

- Establish additional grazing exclosures in riparian areas on Forest Service lands, especially the Santa Fe, Lincoln, and Carson National Forests to support expansion of extant populations of the jumping mouse and possible reintroduction to historically occupied habitat where natural expansion is unlikely.

- Identify and implement practices to reduce impacts to riparian areas on Forest Service lands with extant populations, adjacent riparian areas where extant populations could expand, and sites for possible reintroduction to historically occupied habitat where natural expansion is unlikely (e.g., development of alternative water sources away from the riparian zone and moving pasture gates away from riparian areas would be beneficial for the jumping mouse).

- Conduct additional surveys for the jumping mouse in the Sangre de Cristo Mountains and the Rio Grande Valley, including private lands and Pueblos.

- Continue to mow only one side of irrigation canals and ditches on Bosque del Apache National Wildlife Refuge.

- Develop a conservation strategy for the species, to guide coordinated conservation efforts by multiple partners.

- Develop and implement a beaver management/restoration plan for historic and extant jumping mouse localities in conjunction with NMDGF.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	2
		Subspecies/population	**3***
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The New Mexico jumping mouse is exceedingly rare and its current distribution is disjunct and relictual due to extreme habitat fragmentation (see entire reports by Frey 2005a; 2006d; Frey and Malaney 2009, p. 38). There are only two localities within the entire historic range that do not have any apparent ongoing threats that imperil extant populations. Nine of the 24 extant localities are only a few acres in size and are widely separated from other occupied localities (see entire reports by Frey 2005a, 2006d). Recent surveys documented a marked decline in the number of occupied populations and suitable habitat across the range of the species in New Mexico and Arizona. Based on the low number of extant populations, the extremely small size of most of the populations and the lack of suitable habitat into which they can expand, fragmentation of habitat that makes it unlikely the extant populations can interact, the lack of adequate regulatory protection of habitat, the continuing destruction or modification of habitat on public and private lands, and the lack of direct management actions to conserve the jumping mouse, we conclude that the magnitude of threats to this subspecies is high.

Imminence: The degradation of herbaceous vegetation along streams in many areas of suitable habitat and current occurrence due to drought and excessive grazing poses the most immediate threat to this species. Presence of a functioning livestock exclosure was reported as the best predictor of jumping mouse occupancy (Frey 2005a, pp. 59-60; Frey and Malaney 2009, p. 35). The Forest Service has not changed management (i.e., avoided or mitigate negative impacts) of grazing allotments where small localized jumping mouse populations are at high risk of extirpation. Livestock grazing has been documented in at least 4 of the extant localities (Frey 2005, pp. 25-26, 29, 36; 2005b p.2; 2006, p. 1). The majority of extant localities in New Mexico are surrounded by riparian habitat that is fragmented or unsuitable for the jumping mouse

because of livestock grazing (Frey 2003, pp. 10-14; 2005, pp. 15-40; 2006d, pp. 10-33). Future livestock grazing will likely continue to remove tall, dense riparian vegetation from extant localities and areas adjacent to them. Consequently, there are imminent threats to this species.

___ Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? YES

Is Emergency Listing Warranted? No. Although limited in number, three of the 24 extant localities have no apparent ongoing threats. These are located within New Mexico State Park lands. As noted, we have no information on population size or stability in these localities. One of these was only discovered in 2006. We will attempt to collect population information from the 24 localities; however, the information we currently have on the status of extant localities and threats, we do not believe this species should be emergency listed. As noted, we have funded a jumping mouse study at Bosque del Apache Wildlife Refuge that began in January 2009. With the conclusion of this study in 2011 and information from other localities, we will be able to make a better assessment of the status of the species. As part of the species' spotlight action plan, we are also pursuing the development of a cooperative conservation effort with the Forest Service, NMDGF, Bosque del Apache Wildlife Refuge, and New Mexico State Parks.

DESCRIPTION OF MONITORING: Monitoring has been both intensive and extensive (please see information reviewed above under the Current Range/Distribution section, above). Frey's jumping mouse surveys in New Mexico during a 4 year period from 2003-2006 involved 82 historically occupied sites and ten localities that appeared to have the highest quality potentially suitable habitat. Only 65 individual jumping mice were caught during a total of 30,165 trap nights. In 2008 and 2009, extensive surveys in the White Mountains of Arizona detected the jumping mouse at 13 of 30 localities (Frey 2008, pp. 2-3; 2010). In 2009, intensive monitoring occurred on Bosque del Apache National Wildlife Refuge, documenting 14 mice at localities (Frey and Wright 2010, p. 12).

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: NMDGF reclassified the species from threatened to endangered in 2006 due to their analysis of current threats. The species is listed as imperiled in the New Mexico State Wildlife Action Plan's list of species of greatest conservation need. The New Mexico Department of Game and Fish, Arizona Game and Fish Department, and Colorado Division of Wildlife were contacted as part of this assessment. They provided survey data and status information and reviewed the assessment.
Indicate which State(s) did not provide any information or comments: none

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: _____ May 21, 2010

Acting Regional Director, Fish and Wildlife Service Date

Concur: _____ Date: October 22, 2010

ACTING

Director, Fish and Wildlife Service

Do not concur: _____ _____

Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 2010
Conducted by: Eric Hein